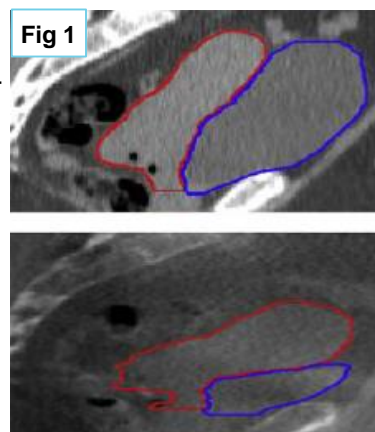


Introduction

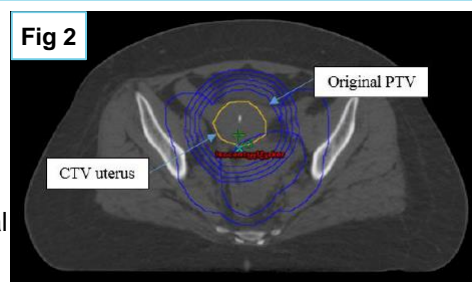
VMAT techniques for Ca cervix patients offers the potential for improved conformity and reduced toxicity compared with standard CRT. On-treatment verification based upon the soft-tissue of the uterine cervix is both difficult (requiring specific training) and complex (given the large internal motion of the uterus). Fig 1 shows typical motion related issues for the bladder (blue) with respect to the uterine volume (red); similar issues are associated with the rectal volume [1]. But accurate verification is necessary, especially given the high dose gradients involved with VMAT and similar IMRT techniques.

This service evaluation examined whether a set CTV-PTV margin could still provide adequate coverage, when using more practical bone-registration matching using CBCT.



Description

Retrospective CBCT scans for 17 patients (240 scans) were analysed using off-line review tools to visually assess (in all three principal planes) appropriate coverage of the uterine cervix for a range of CTV-PTV margins, when simple bone-registration matching was used. Fig 2 shows the CTV uterus (yellow) and the original PTV which includes the nodal volume, grown 1 cm from the CTV. The margin was then expanded in 0.5 cm increments up to 4 cm.



Each CBCT scan was visually analysed choosing the best PTV contour for overall coverage. The dosimetric consequences of the variation in required margin was examined in three of the 17 patients.

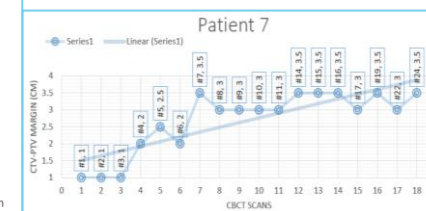
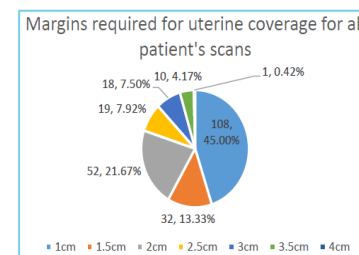
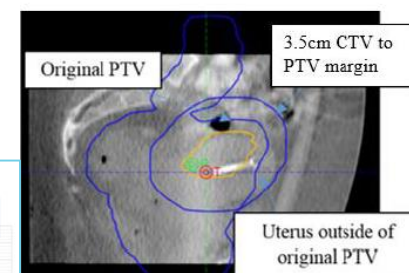
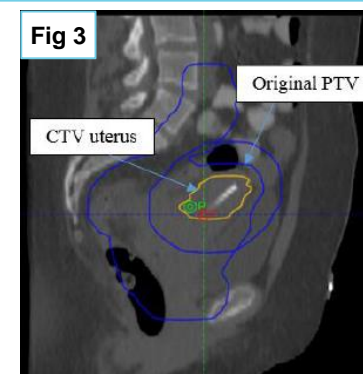
References

1. Jadon et al. 2014. A Systematic Review of Organ Motion and Image-guided Strategies in External Beam Radiotherapy for Cervical Cancer. *Clinical oncology*, **26**(4), pp. 185-196.

Results and Discussion

A large variation in CTV-PTV margin was needed for adequate coverage across all patients. Fig 3 shows a typical example; for the original plan (top), the uterus is fully within the 1 cm CTV-PTV margin. However on the CBCT scan (bottom), changes in bladder volume have affected the uterine position and coverage; a margin of 3.5 cm (when assessed in 3D) was now required for adequate visual coverage.

Maximum margins ranged from 1-4 cm; mean margins 1-2.7 cm for all patients (below). Variation across the treatment course was high, ranging from no change to 3 cm; the chart plot below shows a typical example of this. Thus, no single margin could be used with straightforward bone-registration. Significant changes were seen in the OAR DVH data for the three patients examined – but noting that even in the original plans, dose constraints were often compromised.



Conclusion

Straightforward bone-registration matching is not suitable with a standardised margin for these patients. Adaptive solutions are needed e.g. combining bone-registration with plan-of-the-day approaches, integrity verified by further dosimetric analysis

Acknowledgement

We are greatly indebted to Angela Baker (now Superintendent Radiographer, Mount Vernon Cancer Centre) for the initiation, pilot work and guidance at the start of this MSc project